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THE TECHNIQUE OF PHOTOGRAPHING INSECT SPECIMENS

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In photographing insect specimens, differentiation of color is important chiefly when it is desired to separate those colors that are in juxtaposition. The correct rendering of colors in monochrome, although to be desired whenever possible, is not necessary, and in many cases it may be definitely detrimental and hide some pattern that otherwise would be a means of identification. However, the rendition of form in great detail is important, and this detail should, as nearly as possible, cover all parts of the subject unless a definite attempt is being made to accentuate some particular part. Backgrounds should be plain, and shadows should be avoided to prevent confusion.

The technique used by the writer is described herein. This is not an attempt to convey the idea that it is the best to be used, but it does indicate that good results can be obtained with simple methods and equipment.

Preparation of the Specimen

Whenever possible, a freshly killed specimen is used. This obviates the necessity of relaxing it. When a lateral view is to be shown, the legs and antenna, and in some cases wings, are removed from one side. If this is done, these parts which would be badly out of focus will not confuse the picture. A minute quantity of shellac is applied to the side from which the legs were removed and also a little to the glass slide. When these become tacky the specimen is mounted with the legless side on the glass. Legs and antenna are then suitably arranged. When a dorsal view is desired, a little fast-drying varnish, such as is employed for putting decalcomanias on cars, is applied to the feet. This allows more time for arranging the appendages, since it hardens somewhat more slowly than shellac.

Equipment

The camera used at the forest insect laboratory at Morristown, N. J., is of the macrographic type (4 by 5 inches), having a bellows draw of 60 cm. An additional extension of 25 cm. is obtained by using a piece of mailing tube having one end fastened to

a lens board and the lens fitted to the other end. This extension, however, is seldom necessary except for macrographic work. For photomicrography a monocular microscope (fig. 1) is used. It has a tube 35 mm. in diameter instead of the extra large tube which is usually specified for photographic purposes. The ocular is dispensed with, and the drawtube is also removed.

The lenses are the ordinary achromats supplied with the microscope for visual work. For most work a 32mm. objective is used (fig. 3). When a slightly higher power is desired the lower or front lens of a 16-mm. objective is unscrewed and only the upper combination is used. Whenever either of these lenses is used a stop is made by punching a 1/8-inch hole into a disc of black paper and sticking it lightly to the rim of the objective barrel in front of the lens, care being taken to see that the center of the hole is in the optical axis. Rubber cement or a minute quantity of glue is satisfactory for mounting the diaphragm to the lens barrel. The use of this stop increases the depth of field and also eliminates the spherical aberration encountered in these lenses. The use of apochromatic lenses would probably give superior results, but the above technique has produced good pictures. Although stops of less than 1/8-inch diameter have not been used, there is reason to believe that if they are made much smaller than this the image would be fuzzy, owing to "pinhole effect". For slightly lower magnification a 48-mm. apochromatic objective has been used (fig. 2). This lens has an adjustable diaphragm built in it.

Lighting and Backgrounds

Lighting the specimen is the most important operation. Although the methods employed are simple, good results have been obtained. A good background is obtained by using a cell made as follows: Rack the substage condenser down and lay a piece of matte white cardboard on top of it, and then rack it up again until the cardboard is pressed against the underside of the microscope stage. The walls of the cell are then formed by fitting a strip of tinfoil about 3/4 inch wide around the inside of the hole in the microscope stage. A deeper cell can be made by using a wider strip of paper for the cell walls, in which case the cardboard bottom and the substage condenser are correspondingly lowered. This method will give a white to gray background, depending on the depth of the cell. A dark-gray to black background is obtained by making a cell in the same way, but using matte black paper, such as is used to separate films when they are packed at the factory. To obtain a good black background the cell should be fairly deep. The latter may also be obtained by allowing the lens to look into space if the camera is operated in a horizontal position.

The light source should produce a concentrated illumination. A spot of light ranging from $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter is quite suitable. Most of the lamps sold for this purpose work well. A slide projector will serve the purpose but may be found rather

cumbersome. Anyone handy with tools can fabricate one similar to the commercial types, substituting a photo-flood for the usual ribbon-filament lamp.

To prevent deep shadows those parts of the specimen on the opposite side from the light source are illuminated by reflected light. This is obtained by simply placing a piece of tinfoil, bent slightly U-shaped so that it will stand up, close to the shadow side of the specimen. A piece ½ inch high by 1 inch long is satisfactory, but care should be taken to see that an image of the piece of foil is not reflected from the specimen slide. This can be checked by careful examination of the ground glass.

The best lighting arrangement will of course vary with each specimen, and this can be found most easily as follows: First, place the light source so that it is slightly above the specimen and arrange the small tinfoil reflector as previously described, and then, while carefully watching the ground glass, slowly rotate the microscope stage. As the stage is revolved it will be found necessary to move the reflector occasionally to keep it approximately opposite the light source. If with one complete revolution of the stage no lighting was found suitable, the light source may be raised or lowered and the operation repeated. In some cases it may be necessary to have the light source so oblique as to be almost at right angles to the optical axis of the camera in order to obtain proper contrast with the background when a black cell is used. This latter method was the only one found satisfactory in photographing the two smaller elm bark beetles, Scolytus multistriatus (Marsh.) and Hylurgopinus rufipes (Eich.). In the case of S. multistriatus the pedal extremities, being translucent, merged with a white or illuminated background, while the dorsal parts, which were very dark brown, merged with a black background. With the extremely oblique lighting, however, the specular light from the hairs that cover the body gave good contrast with a black background.

Miscellaneous Information

In photographing larvae and pupae, a flask filled with a solution of 1 part of copper sulfate to 2½ parts of water makes a fairly good filter. This refers to specimens that are almost white or slightly pinkish. In photographing the larvae, best results have usually been obtained by illuminating them from the anal end.

The lowest power objective compatible with a fair magnification should be used. For specimens 2 to 3 mm. long, magnifications are usually 20 to 30 diameters. If larger images are desired, they are obtained by projection printing.

Panatomic film is usually used; this is fairly contrasty material and is much better than plates for storing, as the Wratten M plates are bulkier and likely to be broken.

When oblique lighting is used, dust particles on the specimen slide may be rather conspicuous on the black background. As many of these as possible should be removed with a small camel-hair brush. Any, however, that show on the negative may be removed with Farmer's reducer. Those proximate to the image may be removed more safely with a razor blade.

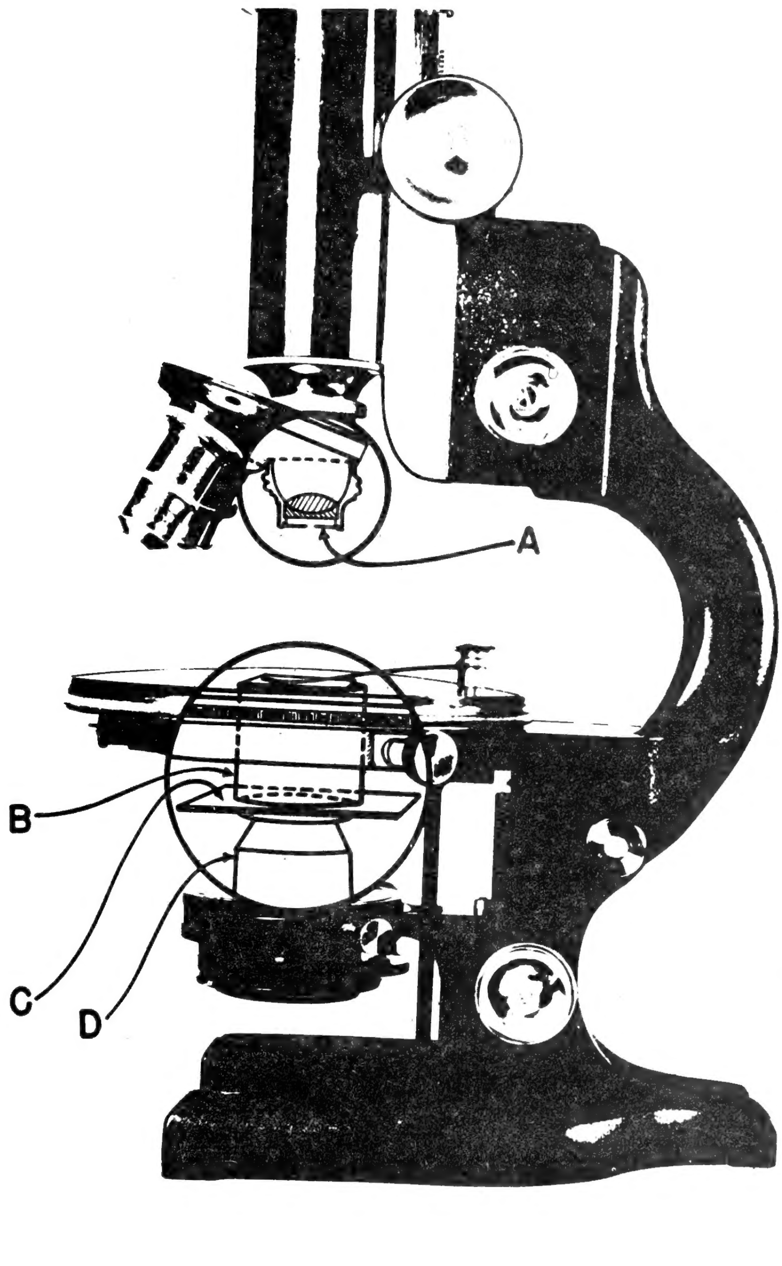

Figure 1.--A monocular microscope prepared for use in photomicrography: A, Black-paper diaphragm stop in a 32-mm. objective; B, wall of cell used for background; C, bottom of cell used for background; D, substage condenser.

Figure 2.--Xylobiops basilaris (Say), x 23. Taken with a 48-mm. apochromatic objective.

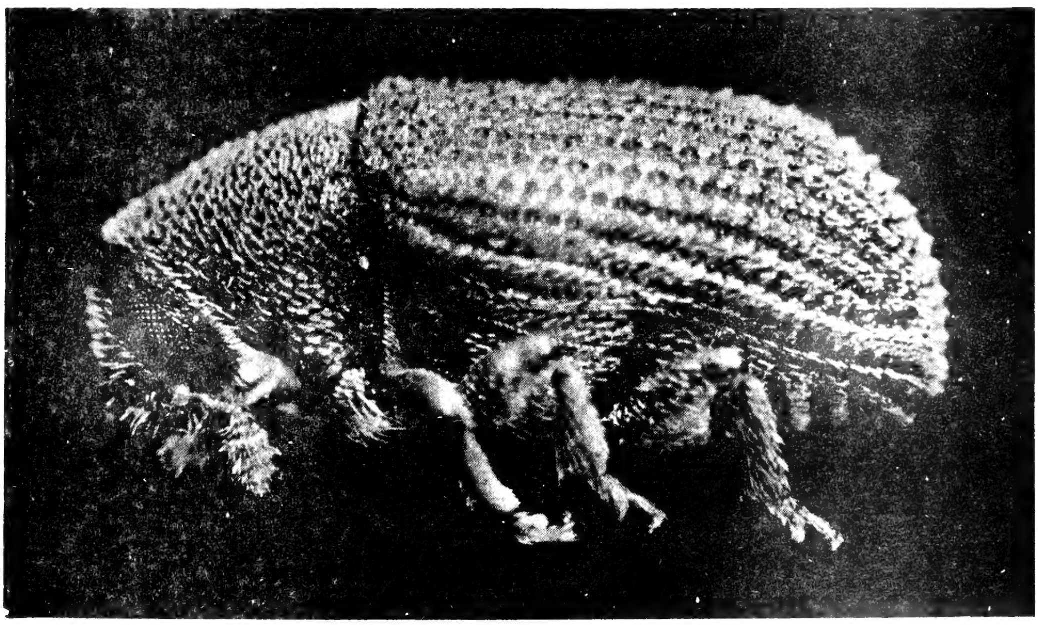

Figure 3.--Hylurgopinus rufipes (Eich.), x 43. Taken with a 32-mm. achromatic objective.